BBSS Launch Operations

I. Purpose:

The purpose of this procedure is to describe the work process performed by the on-site observers to perform the launch of the Balloon-Borne Sounding System (BBSS) (Vaisala DigiCORA II MW15) at the TWP ARCS sites.

It is important to be ready to launch on time. Balloons need to be launched at 11:30 and 23:30 UTC. The other countries in the Pacific, and around the world, will be trying to release their balloons at the same time so that a “snap shot” of the atmosphere at 00 and 12 UTC is taken. This is best for forecasting purposes and an accurate climate record. Giving yourself plenty of time means, if you need to prepare a second sonde, you will still be able to release the balloon on time.

II. Cautions and Hazards:

- Take care in operating the hydrogen generator during balloon filling (see safety procedures for hydrogen generator).
- Launch only under safe meteorological conditions: Wind speeds below 20 m/s, no electrical storms.

III. Requirements:

- Operating DigiCORA.
- GPS Sonde package with calibration tape and water activated battery.
- Meteorological balloon (350 grams).
- Cable ties or string to tie off balloon.
- Bung, nozzle, needle
- Helium or Electrolyser for hydrogen lifting gas.
- Electrolyser enclosure.
- Gas-Flow Valve Box.
- Operating GPS and UHF (either directional or omni-directional) antennas.
- Balloon launching facility w/RBL.
- Aspirated box for pre-launch sonde conditioning.
- Laptop PC with BBSS and PCMF software.
- Small screwdriver for adjusting sonde frequency.

IV. Procedure:

PRE-RELEASE PREPARATION

(30 minutes before release time):

Check if any airplane flights are scheduled for arrival or departure at Nauru airport. Telephone the tower 10 minutes before the release to ask permission to launch the balloon if air traffic is expected.

PREPARE BALLOON TRAIN

(20 minutes before release time):

1. Go to the E-Van:
    - Turn on BBSS Computer using the switch on the side of Laptop Computer (if not already on). ***If it's already on, press ESC and then press Y to exit the BBSS program. It will return to Desktop.*** "Double click" the "beach ball" icon (it is labeled "MV" at Nauru, "Balloon" at Manus) on the desktop to [re]start the BBSS program.
    - Check the year, month, and time for correctness (if incorrect, not in comments in the Daily Rounds), then press "Enter" key (this will be the launch "time stamp"). It is important to do this before turning on the DigiCORA.
    - Turn the DigiCORA OFF (if necessary) and then ON (power up takes 5-10 minutes).
2. Go to Balloon Van:
    - Retrieve a balloon, a bung, a nozzle, a sonde string
    - ***Note: Launch the oldest radiosondes first.***
    - Put the nozzle in the bung.
    - Put the arrow point needle on the nozzle.
    - Put the nozzle in the bung press.
    - Press the nozzle into the bung.
    - Pull out the bung and remove the arrow point needle.
    - Put the neck of the balloon into the balloon neck-expanding jig.
    - Put the bung into the neck of the balloon.
    - Pull the balloon off the neck-expanding jig (REMEMBER to push from the top and pull from the bottom).
    - Put string around the neck of balloon.

- Get a sonde package out.

3. Connect the special black connector to the DCP. Open the DCP hyperterm on the observers laptop. Type CTRL J then ENTER. Reconnect black DCP/Digicora connector.

4. On the DigiCORA:

   - Accept or change date and time (by pressing C4 or C5),
   - Press load SOND (C1), STRData (C1),
   - Press Go On (C5). (See Appendix 1, Normal Sonde Operations Prior to Sonde Launch, of the "DigiCORA II MW15 User's Guide.")
   - Enter sounding #: SsddmmyyN, where:
     - ⇒ Ss=21 for Manus and 22 for Nauru,
     - ⇒ dd is the **local date** of the daylight launch for both the daylight and night launch,
     - ⇒ mm is the month,
     - ⇒ yy is the year and,
     - ⇒ N=1 for first launch (daylight), 2 for second launch (night), etc.
     - ⇒ *For example the first launch of the day at Nauru on 3Apr99 would be 220304991.* (*Note:If typing mistake is made, press left arrow and delete; if OK, press ENTER.)*
   - Accept or change position data (lat, long, and altitude) by pressing C4 or C5.

5. Prepare the sonde:

   - Remove the sonde from the packet and save the package.
   - Write Sonde serial number in "Pre-Flight Sonde Check Form."
   - Get the calibration tape out to use with the DigiCORA.
   - Stick one copy of sonde serial # from sonde paper tape on the sonde.
   - Take battery from packet and soak in water for 3 minutes and dry with a paper towel before putting it in sonde. Connect battery.
   - **Important: Need to launch in 10 minutes or less from this point.**
   - Take the sonde and place it in the Stevenson Screen outside. Close door.

6. Go back to the DigiCORA.
7. When prompted by the DigiCORA, remove white paper section of calibration tape and pull tape through.
   - Wait a few minutes until the sonde settles down(while it runs GPS Sync. You should see it say "*GPS synchronized*", then "Ok to *Release".* Wait for the *Release* command.
   - Read the pressure, temperature and humidity of the sonde on the DigiCora and write these figures in the "Pre-Flight Sonde Check Form" in the "Sonde Measurements" columns.
   - **If the DigiCora will not accept the tape, then manually enter the coefficients using the DATA ENTRY keypad as follows:**
     a) Press the C5 key to enter coefficients.
     b) It may ask type of radiosonde. If so, type in RS80 and press C4.
     c) A prompt for the sond serial number will appear. Sonde serial number is on top of white tape.
     d) You might need to enter up to 50 sets of numbers including serial number.
     e) The DigiCora will prompt you to enter numbers. You will find numbers on the tape (Example: PYO 15729…etc). Verify the numbers match; Use C4 to Accept or C5 or Reject each set.
     f) Repeat for each set of numbers..
8. Go to the Stevenson Screen and read the temperature and humidity on the sensor (wet and dry bulb "chart" at Manus, hand held at Nauru). Go back to the E-Van and read the pressure from the barometer. Write these in the "Pre-Flight Sonde Check Form" in the "Comparison Measurements."
   - The Digicora Temperature, Humidity and Pressure should be within ±2 °C, ±7%, and ± 6 hPa of the Stevenson Screen and barometer values.
   - If the comparison is not within limits recheck the reference instruments.
   - If one or more of Temperature, Humidity or Pressure are still out of tolerance get another sonde and restart in SOND mode.
     ⇒ Take the battery out of the rejected sonde. Keep this sonde and write on log sheet and the outside of the sonde why it failed test.

⇒ Prepare another sonde (the battery from the bad sonde can be used if it has been less then 20 minutes since it was activated).

⇒ *Note:Try the rejected sonde at the next scheduled release and if the readings are within tolerance use it. If it is still outside the tolerance put it in a box marked "rejected sondes" for return to Vaisala.*

9. On the DigiCORA

- Check that the frequency of the sonde before release by pushing (Telem). It should usually be close to 403.00 Mhz.
- Write this figure down on the "Pre-Flight Sonde Check Form" in the column "Frequency". This information is important if you need to release a second sonde (see paragraph: RELEASING A SECOND BALLOON).

FILL BALLOON

Go to the Electrolyser Enclosure.

- Inside the Electrolyser Enclosure, turn the voltage down to 0.
- Inside the Electrolyser Enclosure, turn on the balloon filling valve (V-15 at Manus; V-9 at Nauru). **Note: wait until the compressor has stopped if it is pumping to the gasholder**.
- Get the stopwatch.

Turn on RBL water spray for 3 seconds before putting the sonde on the tray.

Take the sonde out of the Stevenson Screen and go to the Remote Balloon Launcher (RBL).

Prepare balloon train on launch tray, attach black cord to string unwinder and double check that nothing is likely to get tangled up at launch.

- Put sonde in sonde slot (sensors pointing to the air tube).
- Put string on balloon and sonde.

Make a slip knot (the knot of the loop should be half way in the loop, not at either end you are attaching to).

Put the slip knot at the bottom of the bung and make the knot tight.

Put the nozzle into the nozzle holder.

Make another slip knot and attach the sonde.

- Put on the string unwinder inhibitor.
- Open up the balloon.

- **Verify Velcro strap attachment.**

  Note: The buttons in the strap face down and lock into the string winder assembly. The Velcro strap must be put on tightly. The sonde must be laid in such a way so that there is no tangled cabling on the launch table.

- Shut the RBL door.

Go to the Electrolyser Enclosure at the Gas-Flow Valve Box.

- Slowly turn on the Gas-Flow Valve and start the stopwatch.
- Observe the balloon inflate.
- After 4 minutes at Manus, and 3 minutes and 20 seconds at Nauru, close the Gas-Flow Valve.
- Return the stopwatch to the Electrolyser.
- Turn on flashing lights and aspirator fan.

Go to the Release Point and pull the balloon release lever to release the balloon.

Immediately after release switch off the flashing light and aspirator fan. Get nozzle and close RBL.

Get the hand held wind instrument (at Nauru only), go outside, and measure the wind speed and direction. Enter these values in the "Surface Release Conditions & Flight Details Form."

Return to E-Van and read the release Pressure from the Barometer in the E-Van and the Temperature and Humidity from the DigiCORA. Enter these values in the "Surface Release Conditions & Flight Details Form."

Type this information, from the "Surface Release Conditions & Flight Details Form" into the DigiCora and after each data entry press *Accept or Reject(C4 or C5).*

(In the future we want to get surface values using procedure PRO(BBSS)-005, BBSS: Accessing Initial SMET Launch Data for the wind data only.)

AFTER RELEASE

Note: The RS-90 sonde packages have been proven to be much more fragile than the RS-80s. This means that the following steps need to be followed closely. Is the temperature sensor is observed to fail on launch (temperature drops quickly to about –20 °C), launch another package following *BBSS Consecutive (TWO) RS-90 Launch Procedure – PRO(BBSS)-019*.

Go to the E-Van and on the Digicora observe the pressure of the balloon at 10 minutes after the launch (time is displayed in monitoring mode) and enter the value on the "Surface Release Conditions & Flight Details Form." To find this push Data button and EDT, the second group (after the time since release), is the pressure. It may take up to 10 minutes for the information to be processed at the start so you may need to be patient. The screen will go back to monitoring the data when it has commenced to display the pressure information. When this happens, push Data and EDT again to view the data, if needed.

Regularly check the frequency by pushing the Telem button, it should be around 403 Mhz (left hand side of screen), and you should see at least one star (*) on the right hand side of the screen. The more (*) the better. If there is at least one star (*) and it is not beeping the sounding should be OK and does not need to be altered. However if it starts beeping check the frequency by pushing the button marked Telem. If the frequency is not close to the release frequency that you wrote down at the start, you can use the Tune UP or Tune DN button to adjust it to what it was before release to increase the signal strength indicated by the (*). When you see a star (*) again and the frequency is around 403 Mhz it should stop beeping after about 10 seconds.

To check the number of satellites push the buttons status then GPS. There should be at least 4 out of 8 figure 1s (example 11001001) on the right hand side in the section REM (Remote). At least 4 are needed to give good wind speed and direction. If it doesn't there are two reasons why this could be. It might be that the string unwinder has not properly functioned and the sonde cannot see the satellites well. An indication of this is, the figure 1s and 0s are swapping around quickly, or if the number of 1s changes often from say two to three to one and back to four. If this happens you can hope the unwinder will work later in the flight (it usually does improve). If you see this you can write a note on the sheet in the "comments column" saying something like "less then 4 satellites during early part of flight". The other reason why there may not be many figure 1s is that the GPS part of the sonde may be faulty. There is not much that can be done if this is the case.

If there are at least four figure 1s and the DigiCORA is not beeping you can go out to the RBL and collect the unwinder suppresser block and rewind the cord (at Nauru only).

Go to Electrolyser Enclosure and turn balloon filling lever (V-9 at Nauru) to the closed position. Return the voltage to around 230V.

Continue to monitor the launch with DATA and TELEM to adjust reception (stars indicate signal strength; 1-5 is best).

If you are satisfied that the sounding is normal, punch DATA key twice to get into "monitoring data" mode. (See Appendix 4, Data Monitoring During Sounding, in DigiCORA User's Guide.)

On the BBSS computer, check the PCMF12 program to verify the GPSWND.RAW file size is increasing in size. If it is not, note in comments in Daily Rounds.

Throw away calibration tape to avoid confusing tapes at later launches.

Ensure printer paper is loaded in tractor feed of the printer (the printer is powered when the YELLOW power and SEL lights are ON).

The launch ends automatically (message appears on DigiCORA if still in data monitoring mode).

If balloon breaks prematurely (at a pressure greater than 700 hPa), launch another sonde. *(see paragraph: RELEASING A SECOND BALLOON).*

1. Toggle **TELEM** and then press **TEMP** and **PILOT** to print messages on printer. (**DO NOT** press **LIST** or **STATUS** button.)
2. On BBSS Computer press **ESC** and then press **Y** (Names of files appear on screen and then BBSS program exits).

Important note: Make sure you ESC and exit out of the BBSS program before the next flight.

Enter values from the Surface Release Condition & Flight Details Form into Synoptic Weather Report along with sonde serial number***.(At Manus only)***

When sheet is full, fax it to TWPPO with the Daily Rounds.

3. Turn OFF DigiCORA by pressing **OFF** and **ENABLE** simultaneously.

   Note: To reset and restart, press **ENABLE** and **RESET** simultaneously.
4. Wait about three hours and then turn OFF the Electrolyser (this depends upon the next launch schedule).

RELEASING A SECOND BALLOON

It is important to achieve a good result at each release time and there will be occasions when you need to launch a second sonde. The first sonde released will usually still be transmitting on the frequency it was released at (around 403 Mhz) so it will be necessary to alter the frequency of the second sonde away from this. The frequency of the sondes usually increases slightly during the flight so you should adjust the frequency of the second sonde down about 1Mhz below first sonde.

Determine if second release is needed:

a) On the Digicora, push Data and EDT.

b) Perform a second release if there is no signal from the sonde (the Digicora will be beeping and saying CHECK TELEMETRY). First check that the frequency is close to what it was at the start by pushing Telem. If it is and there is no signal, this may mean the transmitter on the sonde has failed.

c) Perform a second release if within 20 minutes after release, you see that one or more of the first five groups, (time, height, pressure, temperature or humidity) is like /////. This means that something is wrong with the flight.

d) If you decide a second release is necessary take note of the current frequency of the first sonde and write it in the comments column.

e) Do not perform a second release if the last two groups (wind direction and wind speed) have ///// ///. These may come back if it is because the unwinder has not worked or if there is a poor alignment of satellites. If the GPS part of the sonde has failed the information will not be available for the flight but a second release is not required.

To prepare for a second release

f) On the Digicora, push Data twice and you should have on the screen, EXIT or RESTART.

g) Push RESTART. You will need to enter the sounding number again and follow the normal procedure until the DigiCora set asks for the tape to be pulled through.

h) Prepare the second sonde. Don't rush because you might forget to do something.

i) Place the sonde in the Stevenson Screen once the battery is ready.

j) Do a Pre-Flight Sonde Check as you do with the first sonde and again reject the sonde if it is not within tolerance.

k) Pull the tape through. Make sure you use the tape for the second sonde (check the numbers on the log sheet if you are unsure).

l) Enter the temperature, humidity and pressure.

m) Now most importantly you must change the frequency. To do this push Telem. Push the button Track (you will see on the top line it shows Trk).

n) Open the slot for adjusting the frequency and using the small screwdriver carefully turn the small screw anti clockwise (in the minus direction). You should see the frequency on the DigiCora

go down. Do this gently and it is not necessary to turn it more then about half a turn.

o) Adjust the frequency to about 1Mhz lower then the frequency of the first sonde. For example if the last reading you took of the first sonde frequency was 403.28 you should try to make the second sonde frequency about 402.28. With some sondes this is not possible to achieve due to manufacturing faults but you should try to make the frequency of the second sonde as close as possible to 1 Mhz lower than the first sonde.

p) Once you have done this push the Track button again and it should say Afc on the top part of the screen.

q) Now you can fill the balloon and release the second sonde. Remember to read the temperature, humidity and pressure and write this in the proper form.

BBSS SONDING TERMINATION:

On the DigiCORA, if you receive a message like, “Sounding stop detected or soundings terminated abnormally,” perform the following to obtain printouts.

r) Press the **CMD** key on the DigiCORA.

s) Press the **C1** key (STOP).

t) View message: “Do you want to terminate the sounding?”

u) Press the **C4** key (YES).

v) View Message: “Sounding terminated.”

w) View **TEMP**, **PILOT**, **LIST**, **STATUS** screen and print out messages from each screen.

V. References:

1. MAN(BBSS)001. – DigiCORA II MW15 User's Guide, Vaisala MW15-U110en-1.5, 11 April 1997.
2. PRO(BBSS)-005. –Accessing Initial SMET Launch Data.
3. Australian BOM recommended procedures from Nauru99.

VI. Attachments:

1. Pre-Flight Sonde Check Form, Release Surface Measurements & Flight Measurements Form; Sample and blank one to copy if needed.

Attachment 1: TWP BBSS Launch Operation Pre-Flight Sonde Check Form (sample)

Site: Manus

Details			Sonde Measurements					Comparison Measurements			Operator
Stn. No.	Date (UTC) ddmmyy	Flt. No.	Sonde Serial No.	Freq. Mhz (Digi)	Pressure Hpa (Digi)	Temp EC (Digi)	Humidity % (Digi)	Pressure hPa (E-Van)	Temp EC (S.Scrn)	Humidity % (S.Scrn)	Initial
21	240999	1	826100302	403.2	832	24.5	33	832	24.1	31.7	LY

Sonde Measurements & Comparison Measurements should be within; *Humidity - 7%, Temperature - 2°C, Pressure - 6 hPa*. If the details are not within the tolerances, recheck the Comparison Measurements. If one or more of Humidity, Temperature or Pressure are still not with the tolerances reject the Sonde and use another. The rejected Sonde should be tried again at the next scheduled flight. If a Sonde is rejected a second time, place it in the box for return to Vaisala.

Surface Release Conditions & Flight Details Form

Release Time		Surface Release Conditions					Flight Details		
Date (UTC) (ddmmyy)	Time (UTC)	Temp EC (Digi)	Hum % (Digi)	Press. hPa (E-Van)	Wind Dir. deg (H.Held)	Wind Speed m/s (H.Held)	Pressure @ 10 min. hPa (Digi)	Pressure @ Burst hPa (Digi)	Remarks
240900	10:45	23	38	832.9	271	5.2	577	400	The flight went well.

TWP BBSS Launch Operation Pre-Flight Sonde Check Form

Site: _____

Details			Sonde Measurements					Comparison Measurements			Operator
Station # 21=Manus 22=Nauru	Date (UTC) ddmmyy	Flt. No.	Sonde Serial No.	Freq. Mhz (Digi)	Pressure Hpa (Digi)	Temp EC (Digi)	Humidity % (Digi)	Pressure HPa (E-Van)	Temp EC (S.Scrn)	Humidity % (S.Scrn)	Initial

Sonde Measurements & Comparison Measurements should be within; *Humidity - 7%, Temperature - 2°C, Pressure - 6 hPa*. If the details are not within the tolerances, recheck the Comparison Measurements. If one or more of Humidity, Temperature or Pressure are still not with the tolerances reject the Sonde and use another. The rejected Sonde should be tried again at the next scheduled flight. If a Sonde is rejected a second time, place it in the box for return to Vaisala.

Surface Release Conditions & Flight Details Form

Release Time		Surface Release Conditions					Flight Details		
Date (UTCl) (ddMonthyy)	Time (UTC)	Temp EC (Digi)	Hum % (Digi)	Press. hPa (E-Van)	Wind Dir. deg (H.Held)	Wind Speed m/s (H.Held)	Pressure @ 10 min hPa . (Digi)	Pressure @ Burst hPa(Digi)	Remarks